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series, and take the last approximate fraction, viz, $\frac{221}{280}$, $x=280$, $y=221$, will furnish two values; also, the preceding fraction $\frac{11}{14}$, $x=14$, $y=11$.

77. **Proposed by G. I. HOPKINS, Instructor in Mathematics and Physics in High School, Manchester, N. H.**

Solve the equation, $(6x^2+x-3)^2-48^2=(x+15)^2$.

I. **Solution by G. B. M. ZERR, A. M., Ph. D., President and Professor of Mathematics in Russell College, Lebanon, Va., and A. H. BELL, Hillsboro, Ill.**

$$\begin{aligned}
&(6x^2+x-3)^2-(48)^2=(x+15)^2.\\
&\therefore\ 3x^4+x^3-3x^2-3x-210=0.\\
&\therefore\ x_1=2.924412+,\\
&\quad x_2=-3.041623-,\\
&\quad x_3=2.804395\sqrt{-1}-.158044.\\
&\quad x_4=-2.804395\sqrt{-1}-.158044.
\end{aligned}$$

II. **Solution by J. MARCUS BOORMAN, Consultative Mechanician, Counsellor at Law, Inventor, Etc., Hewlett, Long Island, New York.**

The *real* roots of $x^4+\frac{1}{3}x^3-x^2-x=70$ (the forms to which the given equation reduces) are:

$$\left.\begin{aligned}
x&=+2.924412\ 149966\ 623189\ 6108(58211\\
x_1&=-3.041622\ 694570\ 750484\ 61819(75892
\end{aligned}\right\}\ \text{true to “(” marks.—\textit{probably} 25 decimals true.}$$

$$\begin{array}{lrlrrr}
\text{Found thus:}\quad x^4\ + & & \frac{1}{3}x^3 & -1x^2 & -1x & -70\\
\text{At sight } x=\pm3\text{(near), try} & -3.04 & & +8.24- & -22.01 & 69.9504\\
\hline
 & -2.71- & \times 3 & +7.24- & -23.01 & 0.04-\\
\hline
\text{Multiply by } -3,\ -.04 & +.13 & & 21.72 & 69.03 & \text{error}+^*\\
 & .1084+ & & 29- & .9204 & \\
\hline
 & +8.24- & & -22.01 & 69.9504 &
\end{array}$$

*The root $\therefore$ is $-2.0316+$ nearly.

Like treatment by $+2.9$ gives 2.925 near true. I get the rest in a more concise way (shorter than Horner's).

The *resulting* equations of above roots are: (the coëfficients appear on *face of computation*)

$$\begin{array}{l}
0=x^3+(+\text{root}+\frac{1}{3})x^2+8.526990\ 472861\ 28178\text{etc. } x+23.936434,541435,17396+.\\
0=x^3+(-\text{root}+\frac{1}{3})x^2+7.237594\ 384604\ 24939\text{etc. } x-23.914031,334310,10968+.\\
\hline
0=(5.966034,\ 84\text{etc})x^2+(1.289496,088257,03238+)x+46.950465,875795,28364+.
\end{array}$$

Hence $x^2+0.216122,\ 788722x=-7.869626,\ 49385$ etc.

$\therefore\ x_1=-0.108$ etc. $\pm\sqrt{-7.890+}$.

Shorter and *more accurate* than Horner's method, *especially* for 5th degree and 6th degree equations.

The other two roots are imaginary.